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| What is the relationship between a  straight – line graph and its equation? |

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| **Useful words and meanings**  origin (0, 0)  *y*-intercept is at - 2  point  coordinates  (4, 3)  *x*-axis  *y*-axis     |  |  | | --- | --- | | **horizontal** | *a line that 'goes from left to right'; a 'flat line'* | | **vertical** | *A line that 'goes straight up and down'* | | **axes** | *more than one axis* | | **point** | *a place on a graph* | | **coordinates** | *the two numbers that tell you where a point is* | | **origin** | *the intersection of the x and y axes. It has coordinates (0, 0)* | | **gradient** or **slope** | *a number that tells you how steep a line is* | | ***y*-intercept** | *the place where the straight line crosses the y-axis* | | **equation of the line** | *the rule that connects x and y together* | | **coefficient of *x*** | *the number in front of the x in the equation* | | **constant term** | *The number that is not 'fastened' to the x* | |

This task will be assessed against **Criterion B: Investigating Patterns** and **Criterion C: Communication**

1. The line *y = x*

Use your Graphic Display Calculator to show you what the graph of ***y* = *x*** looks like and then graph it on the grid paper provided.

* Which direction does it go in?
* What is the gradient/slope of the line?
* What is the *y*-intercept?

This is the starting line for **many**, **many** other straight-line graphs!

1. Now use your GDC to graph; *y* = 2*x*, *y* = 3*x*, *y* = 4*x* …. ie change the ***coefficient of x*.**

Make an accurate graph of *y* = *x, y* = 2*x*, *y* = 3*x*, *y* = 4*x* and put onto the one set of axes.***( Hint: X-axis from -3 to 3 and y – axis from -12 to 12)***

* What can you say about these lines?
* How are they related to the line *y* = *x*?
* What happens to the lines when the ***coefficient of x*** in the equation changes?

1. Using a table like the one below fill in the **slope/gradient** for the 4 straight lines.

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| *Coefficient of x* | 1 | 2 | 3 | 4 |
| Slope/gradient: |  |  |  |  |

1. What is the relationship between the **coefficient of** ***x*** and the **slope/gradient**?
2. Investigate **negative** values for the ***coefficient of x.*** Show evidence of your investigation by providing graphs.

* Which direction do your lines go in?
* What is the gradient/slope of the line?
* What is the *y*-intercept?
* Is the relationship between the **coefficient of *x*** and the **slope** the same as the one you found in question 4?

1. Investigate fractional values for the ***coefficient of x.*** Show evidence of your investigation by providing graphs.

* What is the gradient/slope of the line?
* Is the relationship between the coefficient of x and the slope the same as the one you found in question 4?

1. Using ***m*** for the slope write down a ***general***equation for this type of straight-line graph. ***Explain how you got it.***
2. **Repeat** the same kind of investigative process, but this time use equations that add a number onto the end of the equation (i.e., ***a constant*** onto ***y* = *x***).

So you might try: , ,  

* How are the lines related to the line *y* = *x*?
* What happens to the lines when something is added to the end of the equation?
* What has happened to the y-intercept?
* Can you notice a relationship between the constant and the y-intercept?

1. Investigate negative **constants**.

* What happens to the lines when a **negative constant** is added to the end of the equation?
* What happens to the y-intercept?
* Can you notice a relationship between the constant and the y-intercept?

1. Using ***m*** for the slope and ***c*** for the constant write down a ***general***equation for this type of straight-line graph. ***Explain how you got it.***
2. Using what you have discovered state what the **slope** and ***y* intercept** of the following equations will be:
3.  b)

c.  d)

**Without your GDC sketch the graphs a, b, c, and d above explaining/showing how you got your graphs**

**Please read through the indicators shown in the right-hand column. Your level for these criteria will be based upon the indicators that you have included in your work.**

**Criterion B: Investigating Patterns**

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|  | Level | **Level Descriptors** | **Task Specific Indicators** |
| ***Criterion B***  **Investigating patterns** | **0** | The student failed to submit work or submitted work but it did not reach any of the standards stated below. | You have given little or no thought to what you have written. |
| **1-2** | The student **applies, with some guidance**, mathematical problem-solving techniques to recognize **simple** patterns. | You have written about **some** **simple patterns** in your results and **attempted** to describe them. You have **tried** to use an **appropriate** problem solving technique. |
| **3-4** | The student **selects and applies** mathematical problem-solving techniques to recognize patterns, and **suggests** relationships or general rules. | You have recognized **many patterns** in your results, **described** them and written them as general rules. You have used an appropriate problem solving technique to **some extent**. |
| **5-6** | The student **selects and applies** mathematical problem-solving techniques to recognize patterns, **describes** them as relationships or general rules, and **draws conclusions** consistent with findings. | You have **found a most of the patterns** and been able to **describe** them and write them as **general rules.** You have selected and **correctly used** appropriate problem solving techniques. You have been able to apply your findings to **most** of the questions at the end of the worksheet. |
| **7-8** | The student **selects and applies** mathematical problem-solving techniques to recognize patterns, **describes** them as relationships or general rules, **draws conclusions** consistent with findings, and **provides justifications or proofs**. | You have found **all** of the patterns and been able to **describe** them and write them as **general rules.** You have selected and **correctly used** an appropriate problem solving techniques. You have been able to apply your findings to **all** of the questions at the end of the worksheet. You have been able to explain how you got your general equation for the straight line. |
| **Level awarded by teacher.** | | **Comments:** | |
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**Criterion C: Communication**

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|  | Level | **Descriptors** | **Indicators** |
| ***C***  **Communication in mathematics** | **0** | The student failed to submit work or submitted work but it did not reach any of the standards stated below. | You have given little or no thought to what you have written. |
| **1-2** | The student shows **basic** use of mathematical language **and/or** forms of mathematical representation. The lines of reasoning are **difficult to follow**. | You have **tried** to finish this investigation. You have used **little** mathematical language and notation. A **few** of your axes and graphs are **labelled** **correctly**.  You have given very little explanation or working. |
| **3-4** | The student shows **sufficient** use of mathematical language **and** forms of mathematical representation. The lines of reasoning are **clear** though not always **logical** or **complete**. The student moves between different forms of representation **with some success**. | You have investigated **most** of the different types of lines **clearly** but sometimes you have missed some steps or work is not completely logical. You have used **correct** mathematical language (e.g. gradient, intercept, coefficient) and notation **most** of the time. Your axes and graphs are generally **labelled correctly** |
| **5-6** | The student shows **good** use of mathematical language **and** forms of mathematical representation. The lines of reasoning are **concise**, **logical** and **complete**. The student moves **effectively** between different forms of representation. | You have investigated **all** of the different types of lines in a **clear** and **logical** way. You have used **correct** mathematical language (e.g. gradient, intercept, coefficient) and notation **throughout** your work. Your axes and graphs are **labelled correctly** throughout your work. Your work 'flows' really well. |
| **Level awarded by teacher.** | | **Comments:** | |
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